

REMARKS/ARGUMENTS

Reconsideration of the application is requested.

Claims 8-15 are now in the application. Claim 8 has been amended. Claims 1-7 had been canceled previously.

Support for the limitation in claim 8 concerning the metallic and ceramic materials may be found on page 6, lines 1-21, of the specification and in the original claim 6 (current claim 14). Support for the limitation concerning the final sintering step in claim 8 is found throughout the description, including at the bottom of page 8 of the translated specification.

We now turn to the art rejection, in which claims 8-12 have been rejected as being obvious over Yoshida et al. (US 6,660,420 B1, hereinafter “Yoshida”) in view of Koga (US 6,517,338 B1) under 35 U.S.C. § 103. We respectfully traverse.

Yoshida describes a separator for a fuel cell. The separator is produced from graphite powder. The graphite particles are bound by a thermosetting resin. During the production of the separator body, the base mixture of the graphite and the resin is formed in a two-stage pressing process into final shape. Such a mixture is easily brought into final shape. The separator achieves its necessary rigidity and density when the resin cures at a slightly elevated temperature in the range from 150°-170°C during the second pressing stage. Reference is had to the disclosure in Yoshida at col. 1, lines 44-50; col. 4, lines 49-51; and col 6, line 51, to col. 7, line 4.

Yoshida's process is entirely different from the claimed process, where powder mixtures are processed that are very difficult to press. The powders are recited in the claims as being metals and/or ceramics. Claim 13 includes Cr in the powder. Subsequent to the second pressing stage, the near-final-shape pressed body must be subjected to sintering so as to assure the structural rigidity and sufficient density of the article.

We will not, however, rely solely on the foregoing argument. Instead, we respectfully point to the prior art reference Quadakkers, which describes the pertinent state of the art. Where complex forms such as separators (interconnectors, bipolar plates) for fuel cells are to be formed of chromium-containing alloys, there are two types of processing available in the art, to wit:

The typical form of the plate which can be several millimeters thick with gas channels can be manufactured by conventional machining of sheet material or it can be fabricated by a process yielding a shape close to the final form (near-net-shape process) by powder metallurgical methods (MIM, WPP).

Quadakkers, et al., col. 3, lines 34-38. That is, where powder is used, only MIM (metal injection molding) or WPP (wet powder pouring) is available to the person of ordinary skill in the art. The primary disadvantage of these processes is their requirement for a high content of binder. Shrinkage and/or pore formation during the subsequent sintering process cannot be avoided.

In other words, the prior art does not teach molding to near final shape in a two-stage press where metal and/or ceramic powders are used as the starting materials.

Instead, the only powder metallurgical processes that are considered are MIM and WPP.

The secondary reference Krupa does not properly modify Yoshida to reach the claimed invention either. There, separators are also produced from graphite powder mixtures with a thermosetting resin, and the body is compressed to assure the required gas-tightness. See, for example, col. 1, lines 32-35, and col. 4, lines 26-32.

Again, a person of ordinary skill in art who attempts to produce an intricately shaped body with powder-based metallic (and/or ceramic) materials and press the same into near-final shape is unambiguously directed to MIM or WPP as the only readily suitable processes.

The process according to the invention is based on the concept of enabling the formation of intricate shapes in a power-pressing process by providing for the detail two-stage pressing with carefully controlled press shaping. The claimed formation of the angles and the dimensions of the elevations between the two pressing stages and the final shaping is not shown or suggested in the prior art. The processes using graphite powders and thermosetting resin, and the fact that such easily molded materials may be formed to the shapes and dimensions as claimed, cannot render the claimed invention unpatentable. Applicants are the first to disclose and claim an unobvious invention where metallic and/or ceramic powders are pressed and sintered into final shape, as claimed.

In summary, none of the references, whether taken alone or in any combination, either show or suggest the features of claim 8. Claim 8 is, therefore, patentable over the art and since all of the dependent claims are ultimately dependent on claim 8, they are patentable as well.

In view of the foregoing, reconsideration and allowance of claims 8-15 are solicited.

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